The Implementation of Electronic Health Knowledge Management Systems in a District Health Board: "Respect and Protect"

Using Action Research

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Abstract: This paper describes the implementation of a suite of Electronic Clinical Health Knowledge Management Systems in a New Zealand District Health Board. The implementation team utilized an action research framework, actively reflecting on each sub-stage of the project, and then utilising key learnings from these reflections, in combination with available related literature, to plan for the next implementation stage. A brief overview of key implementation issues/learning and ethical challenges will be presented. The paper will highlight the importance of a systemic shared culture that "Respects and Protects" Health Knowledge. The Use of "I-Mail©" as a reflection tool, and perceived links between Action Research and individual and group psychological processes will also be discussed.

Keywords: Health, Knowledge Management, Action Research, Culture, Reflective Learning, Psychological Processes, Ethics

Background

GLOBALLY HEALTHCARE IS recognised as a sector with some of the greatest opportunities and challenges for Knowledge Management. Electronic information and communications technology based knowledge management systems have been particularly identified as potential catalysts towards safe, timely, coordinated and integrated, effective and efficient healthcare. However, historically successful cost efficient implementation of clinician accepted and valued systems with sustained identifiable benefits have proven difficult (Ash 1997; Heeks, Mundy & Salazar 1999; Shiffman, Liaw, Brandt & Corb 1999; Weiner, Gress, Thiemann, Jenckes, Reel, Mandell & Bass 1999; Berger & Kichak 2003; Ash, Berg & Coiera 2004; Ash, Gorman, Seshadri & Hersh 2004; Garg, Adhikari, McDonald, Rosas-Arellano, Devereaux, Beyene, Sam & Haynes 2005; Koppel, Metlay, Cohen, Abaluck, Localio, Kimmel & Strom 2005).

New Zealand is recognised as having one of the most Information and Communication Technology (ICT) enabled and integrated healthcare sectors in the world. Clinical information systems are widespread in primary care, and secondary care is currently developing both its internal Clinical Information System (CIS) capacity, and capacity to communicate electronically with primary care. New Zealand's developments have been assisted by some fundamental building blocks such as a unique patient identifier and secure health network and a focus on clinicians' "coal face" needs.

However New Zealand also faces the global challenges of value identification and analysis, privacy, security, effective implementation, and limited resources and sustainability, and has also only just begun its journey towards an "ideal" electronic Health Knowledge Management System (Protti 2003; Orr 2004; Orr & Day 2004).

This paper describes the implementation of a multifaceted electronic Health Knowledge Management System in a large New Zealand district health board. An action research framework was used by the core implementation team, (that averaged about 10-12 members). This core team then engaged with a multitude of separate support and clinical services, that were required to support, drive, adapt to or benefit from the system implementation directly impacting on at least 2500 of the health board's 4500 staff.

Certain aspects of this implementation have been reported elsewhere (Orr 2004; Orr & Day 2004). However this paper will focus on methodological and ethical issues associated with the implementation, and action research framework. Reflective learning and the use of "I-mail" and links between action research and individual and group psychological processes will be introduced. There will also be an exploration of some of the fundamental qualities or principles that may form

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the foundation of an "ideal" Health Knowledge Management System. This includes the importance of a systemic shared culture that "Respects and Protects" health knowledge.

Research Context

Waitemata District Health Board (WDHB) provides publicly funded primary (general practitioner) and secondary (hospital and community services) care to a population of 450,000 in the west and north of the Greater Auckland region. WDHB, in association with two other local District Health Boards (DHBs), has implemented a series of Electronic Clinical Health Knowledge Management Systems. These systems are integrated within each DHB's secondary care hospital and community services, with limited but increasing integration across the DHBs and with primary care general practitioners (GPs). The focus is on bringing together and sharing clinical information, with the aim of providing better health outcomes and integrated care for individual patients and the wider DHB community.

System developments include:

1. Implementation of a single login interface from which all patient demographics and investigation results (laboratory, radiology), as well as past treatment events and medical warnings held on the national system can be viewed. Laboratory results can be signed off electronically.
2. Implementation of an electronic medical document repository of 250,000 historical clinical documents were migrated, with all dictated/typed clinical documentation now available electronically (from same single login interface) dating back to Jan 2001.
3. Implementation of a patient tracking system for the emergency care center (ECC), which provides real time information on a patient's treatment status and investigation results. "Exit Scanning" provides real time discharges from ECC to the wards.
4. Electronic clinical audit facilities initially focused on the general surgery, orthopedics area providing an initial degree of clinical outcome measures.
5. Real time sharing of discharge knowledge across regional primary/secondary spectrum. At the planning stage of the project in late 2002, the Waitemata area contained approximately 130 primary care practices, staffed by 320 GPs and an approximately equal number of practice nurses.

In keeping with the local model of integrated care and supporting increasing links between the primary and secondary care sector, the long-term vision would be to have seamless sharing of relevant information between all appropriate stakeholders. The CIS project as a first step towards this, identified electronic messaging to the primary care sector as a key component. Major scope areas of this component included:

1. Compiling an up-to-date GP contact database
2. Enabling electronic messaging and provision of referral status messaging and electronic discharge summaries

An additional benefit of a real time electronic discharge summary is that the patient is also able to receive a legible, typed summary of their care and GPs and community pharmacists can more readily identify and contact the discharging clinician for further information or clarification.

Aims of Research

The study sought to develop an action research based conceptual model (built on identified key issues and variables) that may enhance the implementation of electronic Health Knowledge Management Systems at Waitemata.

Action research was selected as the methodology due to its focus on change and learning, its qualitative, explorative, theory building emphasis, accommodation of researcher participation, and responsiveness and flexibility in complex changing situations.

The action research process involved a preliminary conceptual stage, comprising a literature review, communication with practitioner and academic experts, and integration of personal interests and experience. The action research stage comprised data collection, using participant observation, personal and group reflection; individual convergent interviews; and document examination, with continual triangulation of sources looking for disconfirming evidence.

The project team was primarily composed of seconded clinicians with varying levels of formal project and Information Systems experience, complemented by a small number of external specialist IS contractors.

The first author had three roles within the project environment: that of action researcher, Clinical Director of Information Services and practicing clinician.

The project implementation timeline was largely focused on the period Feb 2003 to Nov 2003. However preliminary planning and wrap up work extended between late 2002 to mid 2004. Over 2000 clinicians and allied support staff have been trained

and provided access to appropriate components of the system.

Incremental Implementation and Action Research-Shared Reflective Learning Approach

Waitemata DHB strategically adopted an incremental maximising of local intellectual capital approach building on previous learning, not just in software development, but in local implementation, environmental analysis and change, and user experience. Waitemata DHB aimed to avoid the common "concept-reality" gap of underestimating the risk, time and resource requirements (not least the significant process or cultural change required, when implementing a large electronic Health Knowledge System in a complex Health environment (Goldberger 1996; Glouberman & Mintzberg 1996; Ash, 1997; Bryant 1998; Heeks et al 1999; Kaplan 2000; Bovey & Hede 2001). Earlier versions of many of the systems had been developed and implemented via a partnership between local software companies and the neighbouring Counties Manukau DHB.

Building and leveraging on Counties Manukau DHB's Blueprint and experience facilitated: lowering of implementation risk; resource and time requirements; and more rapid adoption and diffusion of the systems among Waitemata DHB clinicians. Gaining benefit from effective Clinical Knowledge Management, System implementation, development and support Knowledge Management has been a major driver for ongoing strategic initiatives across the region.

Validity and Ethical Issues Associated with Action Research

Action research is an evolving concept which has experienced challenges to its validity, rigour and ethical base throughout its developmental history (Meyer 1993; Rowan 2000; Williamson & Prosser 2002; Hope and Waterman 2003).

A detailed critical analysis or defence of action research is beyond the scope of this paper. However Ortun Zuber-Skerrit (Sankaran, Dick, Passfield & Swepson 2001) identifies action research as lying in the non-positivist paradigm of reflective rationality and offers a potential theoretical framework containing key elements, theories or principles drawn from grounded theory, personal construct theory, critical theory, and systems theory.

Dick (2001) notes that the essence of action research is captured in its name. It seeks either action or change, and research or understanding as outcomes, with the action and research synergistically enhancing each other. Although there are several forms, researcher participation, qualitative data gathering, and cycles of action and critical reflection predominate.

Action research comes with the general caveat that researcher participation focus on a specific situation and lack of experimental control may lead to limited generalisability. However, the iterative process of continually critically challenging and building on data obtained during earlier cycles and triangulation of multiple sources may improve the strength and generalisability of findings.

Despite challenges to its validity, action research's ongoing survival and growth may be attributable at least in part to its ability to help solve real world practical problems where variables cannot be easily identified and controlled but become apparent, evolve, and change dynamically over time.

This may make action research in the area of information systems of particular practical relevance when typically trying to facilitate some beneficial change within a complex dynamic environment (Baskerville & Myers 2004).

Action Research and Psychotherapy

From the first group reflection session meeting, as a psychiatrist, I (the first author) was struck by the importance of strong inter/intra group dynamics and the potential similarity of the whole action research process to both individual and group psychotherapy. There is a long history of debate (not dissimilar to that in action research) as to what the essence of psychotherapy is, but many of the core themes are centred around issues of control, competency and connectedness and improving functioning by helping to contain the chaos that arises for individuals and groups if they do not feel in control, competent and connected to some greater good/purpose within their environment (Goldstein 1999).

During the group reflection sessions, and later during two series of individual convergent interviews, core themes were of control, competency and connectedness, e.g. initially not feeling competent for role, feeling helpless and unable to control environment or others outside the immediate project team (who were required to contribute essential resource), and the lack of a shared common purpose or priority for the multiple teams interacting with the core team (Dick 1998). A central focus for intervention was working on improving essential skills and processes in these areas.

I have some awareness that what we tend to elicit and see is largely guided by our cognitive filters/distortions and assumptions, and if you are a hammer you might only see nails, and if you are a psychiatrist you see psychological processes. However, the issue for me was more around my

perceived level of ignorance and lack of skills to make interventions. Yes, I probably had enough training to begin recognising key psychological processes, and made psychological interventions in my clinical world all the time. However in my clinical world, I would consider myself out of my depth to be engaging in group psychotherapy without ongoing training and supervision. I was also working with a co-worker, who was using a number of group building/change management techniques, and I had several discussions with her with regard to the underlying psychological mechanisms of such techniques, and how in my clinical world I would feel uncomfortable using them.

Origin of Group Dynamics and Action Research

Further exploration of the history and evolution of action research and group dynamics (and helpful feedback from senior action research practitioners) indicated my experiences were not unique or unexpected. Both can be viewed as intertwined since birth, with Kurt Lewin being considered one, if not the, father of both action research and group dynamics.

The study of group dynamics is not limited to psychiatry or psychology; anthropology, sociology, political science, education and business all have a legitimate interest and contribution to make to the field and all disciplines can synergistically learn from each other (Lewin 1948; Group Dynamics 2004).

However I did experience a cognitive dissonance between the perceived professional attitudes, skills and knowledge expected of the specialist psychiatrist and action researcher roles. My perception was that the action research process could involve significant individual and group dynamic processes and boundary issues. In the clinical setting there are expectations of at least minimal standards in terms of attitudes, skills, and knowledge required to recognise and manage such issues. These minimal standards are undoubtedly driven to some degree by a historical and, in certain areas, ongoing lack of standards and resultant perceived harm. These standards may vary among professional groups, and according to type of work and interventions required. Those engaging in actual therapy would be expected to have an appreciation of the theories, complexities, indications, risks and limitations of their practice. They would be expected to appreciate their attitudes, skill and knowledge and capabilities would need time to evolve and require an ongoing context of lifelong learning and supervision or peer review (Dagg & Evans 1997; Rosen, Sukenberg & Saeks 2001).

Action Research and Double Loop Learning

The work of Argyris and Schon (1974; 1978) has highlighted the differences and consequences between single-loop and double-loop learning, espoused theories and theories in use, and Model 1 and Model 2 clusters of governing values. More effective, sustainable, and beneficial problem solving and change may result from an open consensual facilitative Model 2 (as opposed to the more competitive, adversarial Model 1) environment, where the development of insight and alignment of espoused theories, and theories in use, is sought, and double-loop learning, critical analysis and appropriate changing of fundamental assumptions or governing values, occurs (Dick & Dalmau 2000).

To really get at destructive fundamental assumptions and values and change them, developing insight and acceptance, could prove a rewarding endeavour. However, the action researcher has to appreciate the potential difficulties of getting at some of those assumptions and has to be prepared and skilled to deal with consequences.

They may face significant resistance dealing with individual, group and organisational dynamic, cultural and political factors with regards to what is said and done by who and to whom across hierarchies and between professional groupings. The action researcher has to have an appreciation of how they are perceived by participants to fit into this dynamic structure, and the difficulties of being simultaneously a researcher, participant, and colleague.

In action research there is the opportunity not just to paint over the cracks but to dig down into the foundations. Digging down into the foundations to fix fundamental problems may end up with a more stable building; however, researchers also have to ensure they have the appropriate skills, attitudes and knowledge not to bring the building down on top of self and others (Argyris & Schon 1974; Argyris & Schon 1978; Argyris 1993).

Action Research and Crossing the Concept Reality Gap

There is a recurring theme in various disciplines, popular literature and metaphor that as people confront and move through a change or stressors, there may be a dip in functioning. This is illustrated by such concepts as a dip in the reengineering curve, the death valley of change, being lost in the wilderness, or moving through a grief process (Elrod & Tippett 2002). Those experiencing the change or stressor may feel lost, and confused, with a loss of their sense of control, competency, and connectedness. This is of particular concern in a healthcare environment, where any drop or perceived

drop in performance may adversely impact patient safety, can rapidly lead to an abandonment of the new processes, and a return to the old potentially flawed but trusted processes. Healthcare is a complex environment with non-linear dynamics, and it is simplistic to believe that all that is needed for change is to set an objective and map out stepping stones or building blocks and how they fit together. Additionally, the recognition of different cultures or "worlds" holistically existing in the health environment, with potentially conflicting perceptions and motivations that impact on change, is a central concern for the implementation of Health Knowledge Systems (Joshi 1990; Glouberman et al 1996; Lorenzi, Riley, Blyth, Souton & Dixon 1997; Weiner et al 1999; Lauer, Joshi & Browdy 2000).

Action research associated with change in complex dynamic environments should not be perceived as an easy cookbook research choice. Instead it requires a set of skills, attitudes and, knowledge, to help the group continually and critically make sense of their current reality, how they have arrived there and where they wish to head; how to deal with the uncertainty and ambiguity of their current reality, and the choices they need to make to get to their destination.

Appreciation of the complex individual and group psychological processes often associated with action research would contribute significantly to those skills, attitudes, and knowledge. This may require an action research on action research, through continually developing and refining the required skills, attitudes and knowledge for effective practice.

I-mail The concept of I-mail evolved out of Shankar Sankaran's work on "memo to myself", where Sankaran wrote reflective memos to himself as part of his action research based doctoral research. Under the supervision of Sankaran, I used and built on the concept of recording my reflections in the form of electronic mail to myself. Sankaran later suggested the name "I-Mail" for the process. Most of the research's data collection, and particularly the I-mails were recorded on a handheld computer, much in the fashion researchers have often used a notebook and a pen to gather data in the field and capture reflections in a timely matter.

Schon (1987) has argued that different levels and types of reflection facilitate skill and artistry development. The process used for I-mail had similarities to Schon's concept of reflection in action and reflection on earlier reflection in action. That is, almost constantly in my interactions with the project team and environment, I would be recording my observations and the process and my real time reflective analysis of that process, my feelings, cognitions, actions and behaviour. I attempted at times to use a structured format but often just recorded my free flow of consciousness. I named this free-flow material and ideas or insights that just appeared to emerge "chaotic loop learning". Although I did not intentionally try to emulate the free association technique of psychoanalysis, it was interesting to speculate with this free-flow technique on how the subconscious receives and deals with information in a non-linear fashion, and constructs perceptions potentially influenced by different levels of cognitive filters and governing assumptions and values and providing different and possibly less censored insights.

As well as this reflection "in the moment", there has been an ongoing iterative process of reflecting on earlier levels of reflection. With successive cycles of reflection, new insights may develop on where certain issues fit in for the first time, including supervisor provided advice and resources. Again I saw similarities here between supervision and development in a psychotherapeutic context, where one marvels in retrospect at how the supervisor was able to see the paths one was going to travel down before you. This process of eventually seeing what the supervisor had foreseen is likely related to the research and supervision journey providing new attitudes, skills and knowledge and gradually altering one's governing assumptions and cognitive filters.

Chaotic loop learning does not diminish the value of active systematic thinking, but recognises that the subconscious brain may continue to work on ideas, concepts and problems, gathering information and cues from different areas in a non-linear fashion, with ideas and insights emerging more completely formed later. This is similar to the concept of sleeping on a problem and waking up with new insights or solutions.

In addition to I-mail, in terms of iteratively constructing a shared understanding of the process and a constant search for disconfirming evidence, there was an ongoing triangulation process, involving multiple cyclical group reflection sessions, individual convergent interviews, document analysis, and review sessions with the formal change manager.

Action research was initially envisaged as an important adjunct to the formal change and communication process, but with the sense of something separate and carried out at discrete meetings.

However action research and reflective practice was rapidly integrated into the fabric of daily practice and was adopted by the formal change and communication manger as central to the whole change strategy. The change manager adopted and formally completed Williams and Harris's reflective learning log at each significant stage of process and these logs provided valuable comparative data (Jick 1979; Fielding & Fielding 1986; Sankaran 1997; Williams & Harris 2001).

A Health Knowledge System

S.A.F.E	**S**calable **A**ffordable **F**lexible **E**quitable
C.A.R.E.	**C**linical **A**dministration **R**esearch **E**ducation
G.A.P.S.	**G**eneral Practitioner (primary and community care) **A**llied Health Services (Including Secondary and tertiary care) **P**atients **S**upports
F.I.R.S.T.	**F**ast **I**ntuitive **R**obust **S**table **T**rustworthy

Table 1: Closing the S.A.F.E. C.A.R.E. G.A.P.S. F.I.R.S.T. (Orr 2004).

The following section introduces a number of key themes in the area of Health Knowledge Management Systems highlighted during the project implementation.

In attempting to build a model of what an ideal Health Knowledge Management System might look like, a number of core features or principles (which may be independent of technology, time or place), can be identified. These can be summarised in the mnemonic, S.A.F.E. C.A.R.E. G.A.P.S. F.I.R.S.T (ref. Table 1).

A sustainable Health Knowledge System is likely to require shared values and vision. Our vision may be to make a healthy difference by the development of Health Knowledge Systems that facilitate safe and effective integrated care, within a culture that respects and protects both the value and privacy of health information. However recognising the difficulties of creating a knowledge system within the complex health environment, each step or building block towards attaining that vision, including privacy and security developments, needs to be SAFE: Scalable (while retaining utility and implementability), Affordable (in terms of risk, resource and time); Flexible (to meet individual, community local and national needs) and Equitable (in that potential stakeholders perceive a relative advantage for themselves associated with adopting

the change or development) (Joshi 1990; Lauer 2000).

The system should enhance every stakeholder's 'capacity to CARE': that is, to carry out his/her integral *C*linical, *A*dministrative, *R*esearch and *E*ducational healthcare functions (Sveiby 2001). The system should value, integrate, and enable all the key stakeholders: *G*Ps, Allied healthcare services (including hospitals), *P*atients and their *S*upports (GAPS); and be *F*ast, *I*ntuitive, *R*obust, *S*table and *T*rustworthy (FIRST) (Smith 1996; Standards Australia & NZ 2001; Southon 1997; Kaplan 2000; Littlejohns, Wyatt & Garvican 2003).

The term "Electronic Patient Record" typically aims to describe the technology or software that stores the record of care, which may be associated with various levels of decision support. However the term "Health Knowledge Management System" aims to better capture or identify the overall characteristics or components of a system that may facilitate better outcomes for patients and their communities, such as changes in underlying processes and the development of a culture that values, respects and protects the acquisition, distribution, production and utilisation of available knowledge (Davis, Domm Konikoff & Miller 1999; Wyatt, 2001; Standards Australia, 2001; Coiera & Clarke 2003; Orr 2005).

A significant reflective learning theme for the project was that, in terms of innovation diffusion, a sustainable effective electronic Health Knowledge Management System is likely to have a number of key components to its ecosystem, all of which need to be synergistically developed and invested in. These include not just the innovation, innovators, and implementers, but the individuals who will utilise the system, the processes and infrastructure of the "invironment", the "informaticians" researching, guiding and facilitating development of the sector, the investors who must understand value analysis, costs and opportunity costs, and the integrators who must hold it all together from a strategic planning and governance level to real time operational support (Orr 2004; Orr & Day 2004).

Democratisation of Technology

There is an increasing need to support the democratisation of technology, so that technology advancements are used to empower and enhance social equality rather than further deprive the most disadvantaged members of our communities. Typically the benefits of new technology flow most quickly to those who are already most advantaged (Andrulis 1998; DHSS 1980; Victora, Vaughan, Barros, Silva & Tomasi 2000).

Technology Matters

The research literature typically highlights the importance of cultural or process change to successful implementation. However this does not diminish the importance of the technology infrastructure. Technology that is designed to meet Clinicians' needs is central to cultural or process change and clinician acceptance. Technology must be Fast, Intuitive, Robust, Stable and Trustworthy; every second and every click counts. With electronic systems now integrated into their daily work practices, issues such as access, speed of login, device availability, mobility, network and server speed outages, and stability, and integrated proactive responsiveness of the Information System helpdesk, have become daily concerns for clinicians.

The Space Shuttle

The Space Shuttle may be a useful model when considering an electronic Health Knowledge System. You need more than powerful engines; you rely on every part of the ship and the associated processes and support staff, to safely launch the ship, keep it up there, and land it again.

With respect to electronic Health Knowledge Systems, if for a new initiative you can only afford the innovation or software, and cannot or will not invest in the other important sustaining components, patient care is probably best served by rethinking, reprioritising or incrementalising the strategy towards a more sustainable initiative (Orr 2004).

Clinicians' Needs

Perceived "success" and utility of a new system is likely to be influenced by perceived equity, in terms of different stakeholder's perceptions of how it met their needs and impacted them.

Senior Clinicians who already had effective manual processes, for example to carry out a ward round (where paper record and results may have been brought together at the point of care and subsequently updated by support staff), may consider technology a retrograde step. This is understandably the case particularly where the introduction of system has resulted in the loss of support staff or shifting of tasks to expertise-rich, time-poor senior clinicians. New technology can also just result in a duplicate system or channel where information has to be recorded, or may be inadequately resourced in terms of providing timely access via adequate conveniently placed or mobile devices.

An attempt should be made to avoid increasing complexity leading to decreasing utility. A design focus should be kept on making the system fast intuitive robust stable and trustworthy for the

common task and the common user. An attempt should be made not to lose sight of these basic requirements by becoming too caught up in dealing with exceptions, conceptual ideals and the expert user. There will always be deficits in the electronic system (just as there are deficits in non-electronic system), and a need to consider the costs and opportunity costs of attempting to address these deficits within a context where all health dollars have to be prioritised. You may want a BMW, but if all you can afford is the engine, you may be better off buying a whole Toyota instead.

Clinicians need to rapidly Push, Pull and Produce knowledge along multiple interconnecting channels, from multiple locations. There is increasing need for mobile, integrated, multiple modality devices that facilitate data transfer, task management, and various levels of guidance sharing and creation. Although there may be a conceptual focus on providing clinicians codified evidence, mobility across and integration of these multiple channels is increasingly essential. Clinicians need access to patient-specific data, and various levels of passive to active evidential decision support. However they also need to rapidly have access to their colleagues to give and receive guidance, and support to deal with the many aspects of their work that are complex and ambiguous and not easily codified in an electronic system. Some of the many challenges for electronic Knowledge Management are: can you code for passion; the importance of relationships; the value of people and what is lost when people move on; commitment, professionalism and the art of caring and dealing with suffering and ambiguity (Mumford 1995; Smith 1996; Goldbeger 1996; Plesk & Greenhalgh 2001; Orr 2005). In a broader non-health context the MILK (Multimedia Interaction for Learning and Knowing) project has similarly highlighted the importance of context specific knowledge systems that recognise and embrace the complexity of user needs and enhance the fixed, social and mobile aspects of professional practice (Mesenzani, Schael, & Albolino 2003).

Privacy and Security

Privacy and security are a central focus, particularly the need to have a shared zone of acceptance with regards to information flow and privacy and sub-optimal care concerns. Although there are significant concerns with regards to the confidentiality aspects of security, there is also increasing recognition of the importance of data integrity and availability. As models of decision support and privacy protection become more complex, we face the dilemma of whether electronic knowledge management systems should be designed not only to withhold certain information from individuals, but from themselves. That is, if a particular piece of information or result has been classified as confidential, should the technology not utilise it when providing guidance (and effectively provide potentially dangerous advice), if giving accurate advice would potentially indicate the confidential information (e.g. drug interactions) (Orr 2005).

Patients and their Supports and Community

Central to the above-proposed model of a Health Knowledge System is that patients and their supports are an integral, valued component. The electronic system and governing and supporting structures should focus on empowering each individual, group, and community in their own self service, self wellness and lifestyle management.

Building the Supporting Ecosystem and Culture

Implementing the innovation or software is only one component of a wider health knowledge system. There is also a need for ongoing development of the wider supportive ecosystem and culture (Orr & Day 2004). Some of the incremental steps we are undertaking in this regard are:

- Development of a knowledge centre providing governance and support for the creation, acquisition, sharing and application of health knowledge throughout the district health board.
- Development of a senior clinicians' group focused on providing an overview of the Organisation's Knowledge Management technology needs and priorities.
- Developing links with the local university and supporting them in their plans for a National Institute of Health Innovation. This Institute will act as a catalytic heart bringing together academia, the health and IT industry and government, and focus on democratising technology and developing policy and systems focused, not just for those who can afford them, but those communities of greatest need and likely to experience greatest benefit.
- Introduction of a Health Knowledge Management Professional ethics seminar for medical students, as another small step in creating a culture that respects values and protects health Knowledge.
- Creation of an interfaculty, multidisciplinary course founded on the principles of knowledge management with core aims of building networks across the sector and with the key output of every student being publishing a paper in relation to

the practical or conceptual application of an electronic Health Knowledge Management System.

Summary

This report described the implementation of a series of integrated Health Knowledge Management Systems in a large New Zealand District Health Board. An Incremental implementation and action research shared reflective learning approach was adopted. Key issues and variables identified and conceptual models evolved, including characteristics of an "ideal" electronic Health Knowledge Management System, value analysis, privacy and security, and planning, change and Implementation issues. The action research methodology also raised key issues with regards to reflective learning, ethics and individual and group dynamics. Group and individual dynamics were identified as an area in which action researchers may benefit from ongoing training and supervision. The concepts of "I-mail" as a reflection tool, and "chaotic loop learning" were introduced.

Trust is central to Healthcare and Knowledge Management and was central to the complex social fabric within which this project was implemented. A sustainable effective health knowledge system requires trust between and within, and investment in the development of all the components of its ecosystem, not just the Innovators, Innovation and Implementers, but the Individuals, Invironment, Informaticians, Investors and Integrators (Trachtenberg, Dugan & Hall 2005; Thompson & Stonebridge 2005; Politis 2003; Orr 2005).

Appropriate cultural or process change is essential for a successful knowledge system. However having technology that is fast, intuitive, robust, stable and trustworthy is key to this cultural change.

Central to the presented model for an ideal Health Knowledge System, was a focus on enhancing patient's and their support's capacity for self care, and the need for a culture that respects, values and protects health knowledge. For our ongoing developments, democratisation of technology will remain a core value, the need to avoid technology leading to even greater inequities, but instead facilitating access to healthcare based on greatest need and potential benefit.

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